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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,885	12/10/2003	Hitoshi Morita	2635-192	5171

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EXAMINER

ROY, SIKHA

ART UNIT PAPER NUMBER

2879

DATE MAILED: 12/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/730,885	MORITA ET AL.	
	Examiner	Art Unit	
	Sikha Roy	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 December 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>1203.0605</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the two circles generating the outer shape of the conical portion as claimed in claim 10 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New

Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Objections

Claim 10 is objected to because of the following informalities:

Page 25 line 4, 'tow circles' should be replaced by --two circles--.

Furthermore the Examiner notes that the limitation reciting 'surface not projecting over a conical surface connecting said two circles' in claim 10 is not clear.

Proper clarification is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over GB 1497641 to Benedikt, and further in view of U.S. Patent 5,866,584 to Kato et al.

Regarding claim 1 Benedikt (Figs. 1,2 page 1 column 2 lines 65-71, page 2 column 1 lines 39) a spark plug comprising a metal fitting 10 having a cylindrical structure, an insulator 16 disposed inside the cylindrical main metal fitting and having an inner hollow structure, a center electrode 15 fitted in the inner hollow portion of the insulator in a manner that a front end portion of the center electrode projects outward over one end of the insulator 16 and a ground electrode 12 mounted to the main metal fitting and having one end portion 13 opposing to the front end portion of the center electrode with a discharge gap therebetween. Benedikt further discloses the front end portion of the center electrode includes a conical portion (frustoconical portion) 20 having a tapered surface having a taper angle between 20 and 70 degrees and a platinum coating 22 on the tapered portion.

Claim 1 differs from Benedikt in that Benedikt fails to disclose the front end portion of the center electrode including a columnar portion having a diameter in a range of 0.4 mm to 0.8 mm.

Kato in same field of endeavor discloses (Fig. 1 column 2 lines 1-15, column 4 lines 50-65) a spark plug having cylindrical metal shell, insulator provided inside, a center electrode 3 having a frusto-conical shaped portion 32 and a columnar portion 5 at the front end, the center electrode being fitted in the inner hollow portion of the insulator so that a front end portion of the center electrode projects outside the insulator. Kato discloses the columnar portion (metal tip) 5 having diameter D1 between 0.5 mm and 0.7mm. Kato teaches this columnar portion (heat-resistant metal tip) provided on the center electrode insures a very rapid electric gradient around this tip and thereby

facilitating an ionization around the tip to reduce a voltage required to induce spark discharges across the electrodes. With the use of this heat-resistant tip provided on the center electrode it is possible to prevent the spark gap from increasing because it is exposed to high temperature and spark erosion within the combustion chamber.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to modify the platinum coating to a columnar portion (heat-resistant tip) having diameter between 0.5 and 0.7 mm at the end of the tapered front portion of the center electrode of Benedikt as taught by Kato for reducing voltage required to induce spark discharges and preventing spark erosion and hence spark gap from increasing in the combustion chamber.

Regarding claims 2 and 3 Benedikt discloses the taper angle is preferably 45 degrees and hence less than 60 degrees (claim 2) and more than 20 degrees (claim 3).

Regarding claim 4 Kato discloses (column 4 lines 59-62) the columnar portion having length of .8 mm.

Regarding claim 6 Kato discloses (column 4 lines 54,55) the columnar portion and the conical portion are welded by means of a laser.

Regarding claim 7 Benedikt discloses a mount screw (screw-in thread) 11 formed to the outer peripheral portion of the main metal fitting.

Regarding claim 8 Benedikt discloses (Fig.2) the grounding electrode has a single-pole structure.

Regarding claim 9 Kato discloses (column 5 lines 1-11) the columnar portion is formed of iridium alloy.

Claims 1, 5 - 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,866,972 to Matsubara et al.

Regarding claim 1 Matsubara discloses (Figs. 1,2 column 3 lines 21-36,47-66) a spark plug 1 comprising a main metal fitting 8 having a cylindrical structure, an insulator 6 disposed inside the metal fitting 8 and having an inner hollow structure, a center electrode 3 fitted in the inner hollow portion of the insulator so that a front end portion of the center electrode projects out of the end of the insulator, a ground electrode 2 mounted to the main metal fitting and having one end portion opposing to the front end portion of the center electrode with a discharge gap therebetween. Matsubara discloses the front end of the center electrode includes a conical portion 33 having a tapered surface and a columnar portion 34 (noble metal tip) having diameter 0.8 mm ($\phi = 0.8$ mm in Fig. 4) formed to a top portion of the conical section.

Regarding claim 1, Matsubara discloses the claimed invention except for the limitation of the tapered surface of the conical portion having a taper angle of less than 80 degrees. It is noted that ignition voltage can be lowered depending on the position of the columnar portion, which in turn depends on the shape of the conical portion. It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980). Thus, it would have been obvious to one of ordinary skills in the art at the time the invention was made to specify the taper angle of the conical portion less than 80 degrees to provide reduced

discharge voltage since discovering an optimum value of a result variable is considered within the skills of the art.

Regarding claim 5 Matsubara discloses (column 5 lines 4-6) the distance (S) between the tip end of the columnar portion of the center electrode and the projecting end of the insulator is 2.0 mm.

Regarding claim 6 Matsubara discloses (column 4 lines 1-4) the columnar portion is secured to the tapered conical portion by laser welding.

Regarding claim 7 Matsubara discloses the spark plug comprises a mount screw 8 formed to the outer peripheral portion of the main metal fitting.

Regarding claim 8 Matsubara discloses the ground electrode 2 has a single pole structure.

Regarding claim 9 Matsubara discloses (claim 3) the columnar portion is formed of iridium based alloy.

Regarding claim 10 it is evident from the Fig. 2 of Matsubara that the conical portion 33 has an outer shape formed by a circle formed by circumferential surface of the columnar portion and the circle formed on the bottom surface of the conical surface of the conical portion.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 6,215,235 to Osamura, U.S. Patent 6,597,089 to

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Matsutani and U.S. Patent 6,762,539 to Klett et al. disclose spark plug comprising center electrode having a conical portion and a columnar portion at the front end.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikha Roy whose telephone number is (571) 272-2463. The examiner can normally be reached on Monday-Friday 8:00 a.m. – 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (571) 272-2457. The fax phone number for the organization is (703) 308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sikha Roy

Sikha Roy
Patent Examiner
Art Unit 2879